The Effects of Networks among Local Residents on Decision-Making in Housing Redevelopments

Sungjin Yun, and Kabsung Kim

***Abstract*—**Recently, the paradigm shift of urban development from new town development to urban renewal has been shown in Korea. Because housing redevelopment, a kinds of urban renewal, is conducted by union composed of local residents rather than experts, it is important how the opinion of each residents come from. There have been several studies to cover this issue: decision-making factor of local resident, but their analysis only based on demographic or economic background. However, considering many decisions made by subjective situational awareness rather than objective, the key factor of decision-making is not "who he is" but "whom he connects with". In this view, we analyzed how network among local residents affects decision-making by using Social Network Analysis(SNA). As a result, there is significant difference in decision-making by location in the network. This result show the value of network approach in housing redevelopment.

***Keywords*—**Housing Redevelopment, Decision-Making Factors, Social Network Analysis(SNA), U-City

I. Introduction

RECENTLY, as the paradigm shift of urban development has been turned from new town development to urban renewal, there are several studies for urban renewal. Unlike new town development, urban renewal is complexly affected by various actor. Thus these question such as "how do the various actors act" or "how affect the act to decision-making" has attract high attention.

In this context, this study focus on housing redevelopment, a kind of urban renewal. In housing redevelopment, major decisions are determined by union and representative members comprised of local residents. It means major decision makers are not expert but nonprofessional residents. Considering these feature, we assume major decisions made by subjective situational awareness rather than objective, and the key factor of decision-making is not "who he is" based on rational-economic man but "whom he connects with" based on relational social man.

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In this view, we analyzed representative member network of housing redevelopment by using Social Network Analysis(SNA), and how this network affects decision-making in contractor selection. In this process, we aim to discover structure of local resident network on decision-making.

II. Review of the Literature

A. Theoretical Approach of Social Network Analysis

The concept of rational economic man is the foundation of a common discipline. These concept explains diverse phenomenon, but it faces with some limitation on real world. Meanwhile, the concept of relational social man, originated social science, assumes human as actors who act on one's position or network structure. In order to explain one's act or its pattern, therefore, we should analyze "whom he connect with" or "how he relate with".

Social network theory is based on these relational social man, and called "embedding theory" because this theory says one's embedded position in specific network affects their awareness, effectiveness, rewards for behavior([1]). Social network analysis(SNA) is developed as a part of social network studies, and it research social structure by analyzing morphology or patterns of social linkage ([2]). Reference [3] defined social network as attempt of explaining social behavior whose come under network by network's characteristics. There are various network studies covering network structure, density, centrality and so on ([4]).

B. Empirical Studies of Social Network Analysis

Interest in social network analysis and its methodologies - and the theoretical principles behind them - has grown rapidly and across multiple disciplines. Indeed, social network analysis has recently found applications in business, education, public administration, media informatics, sociology, computer science, and geography. Breakthroughs in mathematics, where much of social network analysis is derived, and computing technologies have made social network analysis a very powerful methodological tool for scholars across disciplines ([4]). Recent empirical studies of social network analysis show network has effects on almost all value such as obesity([5]), thinking([6], [7]), quality of life([8], [9]), power([10])

Especially, regarding decision-making what this study aim to show, the social network theory has settled as a stream in

theories of policy making([11]). These regarding studies show network plays a leading role in policy introduction and change. ([12], [13]) Also, there are several studies concerning network' decision-making effects in various unit: classroom([14]-[16]), enterprise([17]), town([18]), community([19]).

C. Empirical Studies of Decision-Making in Housing Redevelopments

There are several empirical studies concerning decision-making in housing redevelopment. A number of studies cover this issues macro approach. Reference [20] show if government give incentive or subsidy to housing redevelopment union, the project put on the verge of cancellation could be sustained.

Some studies approach micro level dealing with each resident's profit. Reference [21] analyze decision making factors on yeas and nays for redevelopment such as residence period, number of household member, type of house, residential environment satisfaction, job location etc. Also, Reference [22] covered same issue and determine decision-making factors: land size, children, rent revenue, satisfaction etc. These studies based on the concept of rational economic man, assumed resident make decision rationally. Meanwhile, reference [23] stepped forward study by including subjective variable: thinking about union leadership, degree of communication, propriety of floor area ratio or contributed acceptance, but still based on rationality.

D. Empirical Studies of U-City

The compound word "U-City" which is similar to "Smart City" is formed from the words "Ubiquitous" and "City". "Law of Ubiquitous City" conducted in 2009 in Korea defines U-City as a city what provides U-service anytime and anywhere through U-infrastructure constructed to improve the city competitiveness and quality of life by leveraging technology. In case of housing adapt U-service, improving quality of housing and residential environment was expected. In this context, over the past few decades, a considerable number of studies like [24], [25] have been conducted on U-service. Several studies such as [26] on U-service point that adapting U-service on housing can increase cost of housing construction, and a few attempts like [20] have been made at financing of U-City.

E. Summary of the Discussion

As noted above, although other decision-making studies performed actively based on relational concept of man, studies of redevelopment are still conducted based on rationality. However, as mentioned in [27], there are distinct differences between expert and nonprofessional, and normal resident's decisions made by subjective situational awareness rather than objective.

Thus, this study judge that social network approach is more reliable to decision-making in housing redevelopment. In this context, this study analyze the effects of network among representative of housing redevelopment union on decision-making of the union.

III. METHODOLOGY

A. Research Data

We conducted the case study of the 5th housing redevelopment district of Bangbae, Seoul, Korea. Because this district is located in Gangnam area with high housing price, it received high attention. Here is a Table which show history of 5th Housing Redevelopment District of Bangbae.

TABLE I
HISTORY OF 5TH HOUSING REDEVELOPMENT DISTRICT OF BANGBAE

Date	Contents
2000.6.17.	Starting Ceremony of Union Establishment Committee
2010.9.2.	Housing District Decision Notification (Seoul 2010-314)
2012.4.7.	In augural assembly of union
2013.7.29.	The Authorization for Project Implementation
2014.6.28	Contractor Selection

The central debate of redevelopment project is contractor selection. It is for this reason that all things about interest lead to construction firms. Thus, we are going to analyze focus on contractor selection.

In redevelopment project, central decision made by union, and union elects a president, directors, auditors, representatives. These leadership forms a committee of representatives. Although contractor selection is decided by the vote of whole union members, these representatives have power in local network and adjust details. From these background, we collected network data of representatives. We asked to representatives: one president, two directors, two auditors, one hundred representatives, our question is "Who did influence upon your decision about this project?" As a result, we obtain network of 117 peoples including the response of non-representatives.

B. Research Method

As mentioned, we would like to analyze by social network analysis. Within network analysis, several levels of analyses are embedded. Networks can be analyzed at the level of nodes (comprised of entities such as individual people or firms), groups (for example, industry or other sectors), or at the level of an entire network system. Two important concepts in network analysis are centrality and density.

We are here concerned with centrality. Reference [28] measured centrality as degree, closeness, betweenness, and eigenvector. First, degree centrality is the simplest type of centrality measures, which is the number of ties of a given type that a node has. Degree centrality can be calculated even in an ego net, without the information of a whole network. There are two kinds of degree centralities: indegree and outdegree centralities. The problem of this centrality is that it does not really indicates the position of a specific node in a network context. While the closeness, betweenness, and eigenvector centralities show a specific position of a node in its whole network based on the relationships with other nodes, degree centrality cannot effectively illustrate how central a node is in a

whole network.

Second, closeness centrality is defined by Freeman as the sum of geodesic distances from a node to all others, where the geodesic distance from a node to another node is the length of the shortest path connecting them. In terms of closeness centrality, small numbers mean that a node is more central, vice versa. However, when inversed and normalized, high score is a short distance from most others. While betweenness centrality measures the brokerage role of a node, and eigenvector centrality measures how a specific node is linked to other "powerful" nodes, closeness centrality tells us the minimum time until arrival of something flowing through the whole network.

Third type of centrality is betweenness centrality. It is a measure of how often a given node falls along the shortest path between two other nodes. Betweenness centrality indicates the extent to which a specific node plays a gatekeeping or toll-taking role. Therefore, unlike other measures, it described the potential capability of a node for controlling flows (e.g., knowledge, information, power) in its whole network: that is, a "brokerage role." Your popularity or close geodesic distance does not necessarily bring you the power to control these resources in your organizational network.

The last type of centrality is eigenvector centrality. One of the general description of eigenvector centrality is a variation of degree centrality in which we count the number of nodes adjacent to a given node, but weight each adjacent node by its centrality. Therefore, if a node has high eigenvector centrality, it has ties with other "well-connected" nodes in the network. Therefore, rather than a simple degree, geodesic distance, or brokerage role of a node, eigenvector centrality indicates to what extent a node is connected to other "powerful and central" nodes in the network. Although a node has a low degree centrality, if the alters are powerful and central in the network, the node will show higher eigenvector centrality than the nodes with more connections with less powerful and central.

Reference [29] could brief these four kinds of centrality measures indicate the followings: 1) degree centrality as the extent to which an actor occupies a central position in a network by having many ties to other actors, 2) closeness centrality as the extent to which an actor occupies a central position in a network by being able to reach many other actors, 3) betweenness centrality as the extent to which an actor occupies a central position in a network by connecting other actors who have no direct connections, and 4) eigenvector centrality as the extent to which an actor occupies a central position in a network by having connections to centrally located actors

IV. Results

The contractor selection vote was a confrontation between A construction firm and B construction firm. Fig 1-4 is the representative network map, and it shows that there are "homophily effect" which means love of the same. In other word, we can find some groups, and the groups has similar characteristic. As shown in Fig 1-4, the network has 4 groups. Group 1 is supporter of A firm, and Group 2 is supporter of B firm. Also, we can name Group 3 "the objectors" due to their interesting characteristics what they always oppose the president's opinion. Considering the president come under Group 1, they should support B firm rather than A. Lastly, Group 4 can be called "the centrist" because they change their decision case by case.

Let's us begin with examining how these network feature leads final vote consequence. Table 2 show the composition of representatives. It might be inferred from these results that B construction firm could get at least 37.6 percent of the votes for Group 2 and Group 3, and it could extend to 48.7% though persuading Group 4. However, contrary to this expectation, the result of the final vote is overwhelming victory of A firm as Table 3. We can understand this phenomenon by network approach. That is to say, A firm' efficient location in network lead these results. We will explain this efficient location with the concept of centrality.

TABLE II
THE GROUP COMPOSITION OF REPRESENTATIVES

Category	Contents
Group 1	60(51.3%)
Group 2	30(25.6%)
Group 3	14(12.0%)
Group 4	13(11.1%)
Total	117(100.0%)

TABLE III
FINAL VOTE CONSEQUENCE

Category	Contents
A firm	721(72.6%)
B firm	234(23.6%)
Abstentions	38(3.8%)
Total	993(100.0%)

We can represent these centrality index in network maps as follow: Fig 1-4. The results show Group 1 has high centrality, and it means Group 1 has not just big size network but also the advantageous position from network point of view. Let's examine closely each index. First, the highest degree centrality level, sixteen, is shown in Group 1. Even if Group 1 has highest degree, it is hard to see a significant difference. It come from the characteristic of degree centrality which is limited to only local level. Yet, our second index, betweenness centrality, overcome this problem. The betweenness centrality consider global level, and it appropriate to explain why this phenomenon is occurred. Seeing network between groups, we can notice these tie is so weak. Although there are various link between Group 1 and 2, there is only one link between Group 1 and 3, and Group 3 and 4. Furthermore, there is no link between Group 2 and 3. In this situation, betweenness centrality is shown high in node which has the link connecting groups. When this important link missing, structural hole can be occurred. Next, our third index, closeness centrality, can be said "accessibility" in other words. The highest closeness centrality is 43.4 in Group 1, and it mean Group 1 can be more easily

access to other whole nodes than other groups. Furthermore, last index, eigenvector, consider transferred power through connecting link. In other word, power like accessibility could be shared with neighborhood node connected directly.

To sum up, our question is “How the A firm can make overwhelming victory with relatively small members?” And the answer is “the A firm has advantageous position and high centrality” This result can be well measured by betweenness and closeness centrality. To confirm these answer, we did operational change to our data. In our analysis, the most important link is the link between Group 1 and 3, we change this link from Group 1 and 3 to Group 2 and 3 as Fig 5 and 6.

We can see highest betweenness centrality in Group 2, 2807, in Fig 5. We can also find the closeness centrality difference between Group 1 and Group 2 is smaller from 4.9 to 1.9 in Fig 6. These change show the importance of link between groups and absent of the link to casting group, like group 3 and 4, lead lose regardless of number of member.

V. Conclusion

This study analyze the effects of networks on Decision-Making in Housing Redevelopments. It was found from the result that more advantageous position lead to high bargaining power and link between groups and network structure help obtaining these position. This study has meaning as follow. First, we study based upon the concept of relational social man unlike existing studies. It can not only help understanding the phenomenon in redevelopment process but also expand a range of application of the concept of relational man. Second, we conducted empirical study and highlight importance of positioning in network structure.

In practically, this study can contribute to establish strategy of contractors who want to secure right to construct. Also, in academically, it broad the effect factor about decision making structure. From now on, a further studies about relational and network approach will be needed to understand real decision making process.

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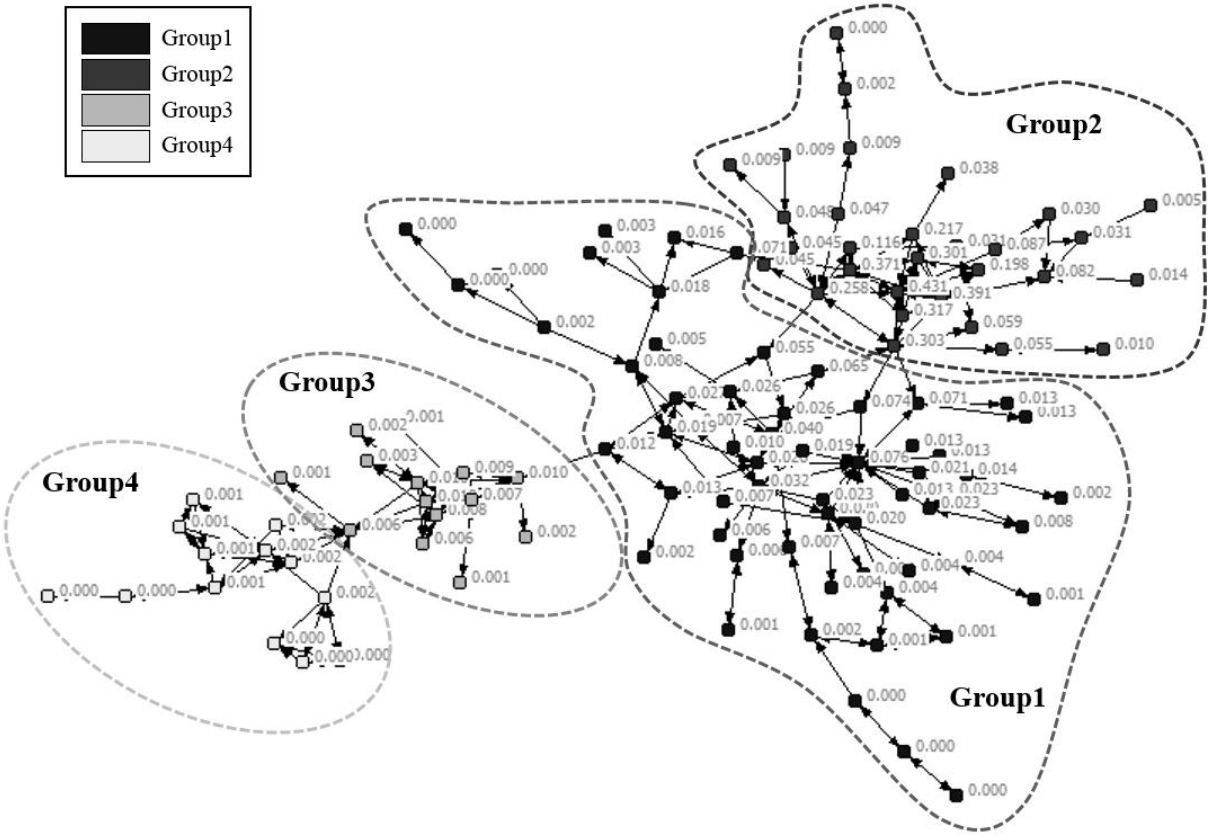

Fig. 1 Eigenvector Centrality Index

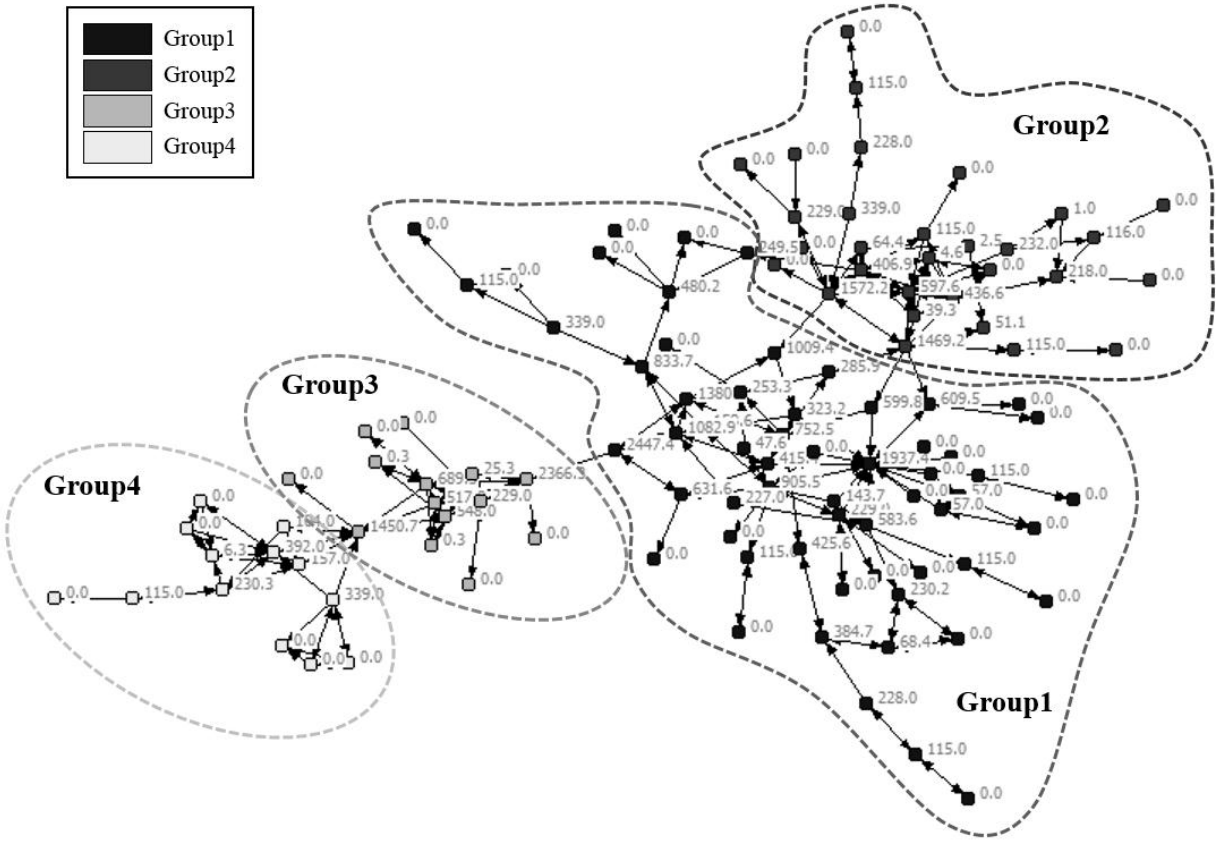

Fig. 2 Betweenness Centrality Index

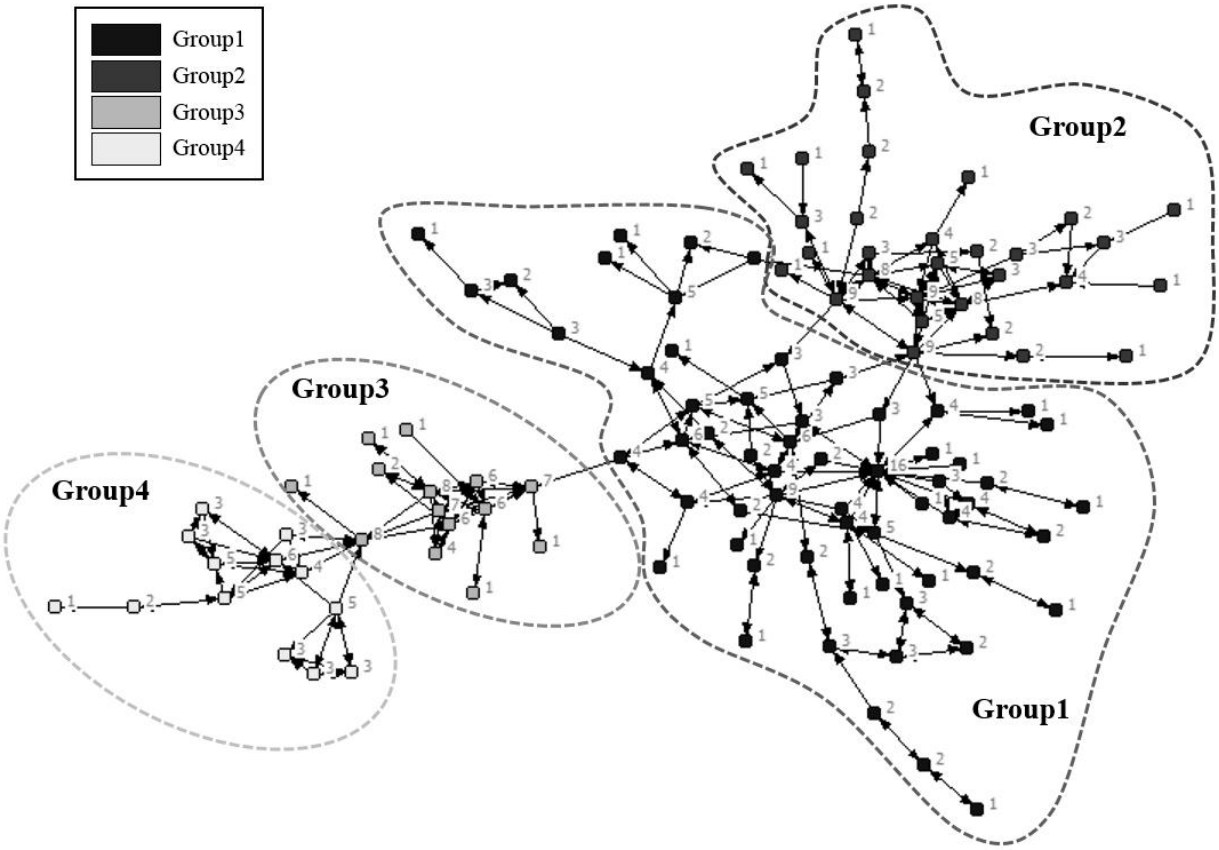

Fig. 3 Degree Centrality Index

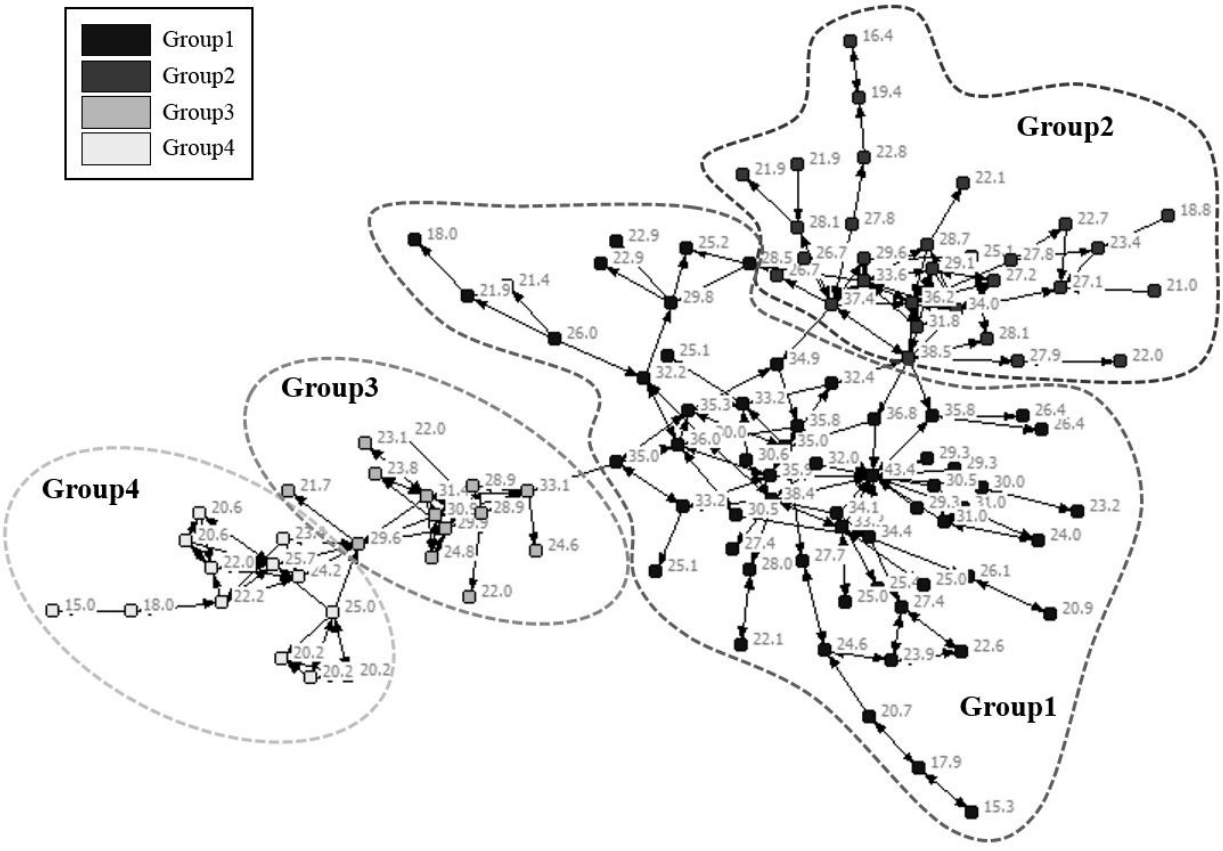

Fig. 4 Closeness Centrality Index

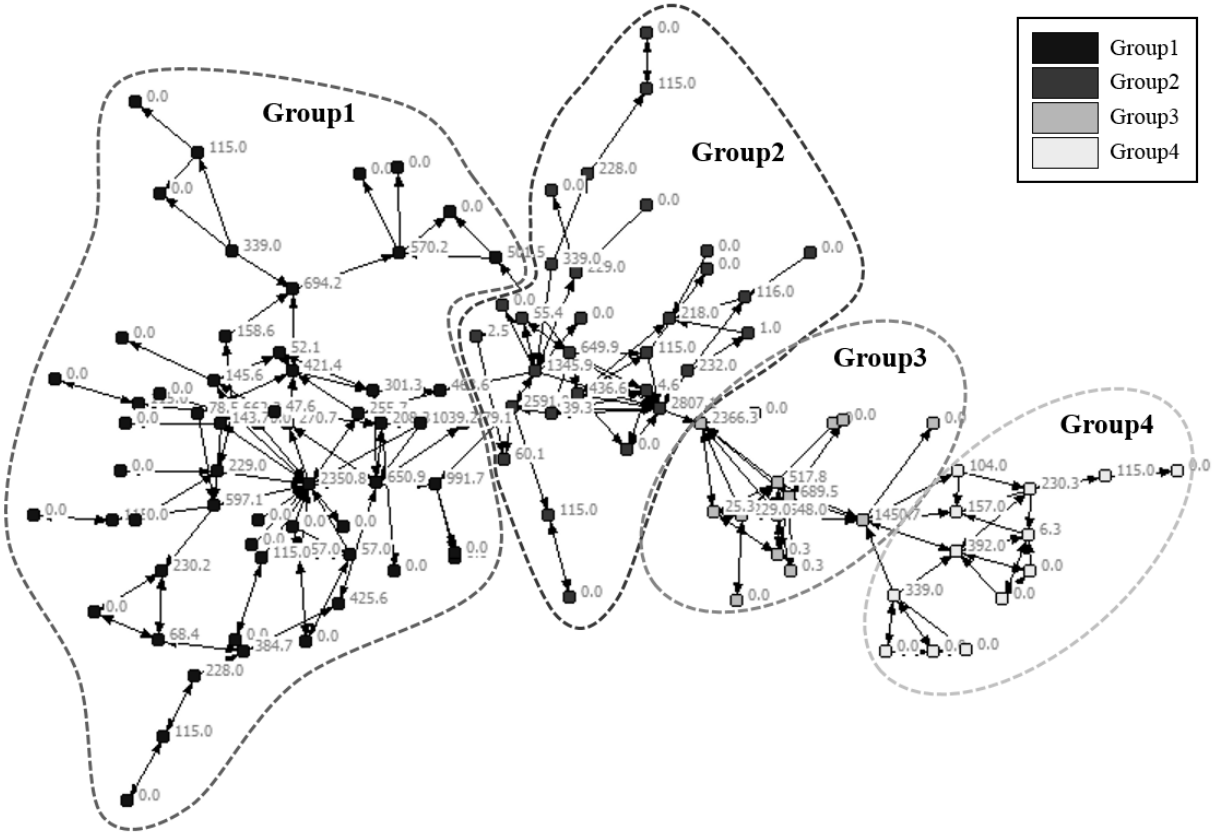

Fig. 5 Betweenness Centrality Index (Assumption)

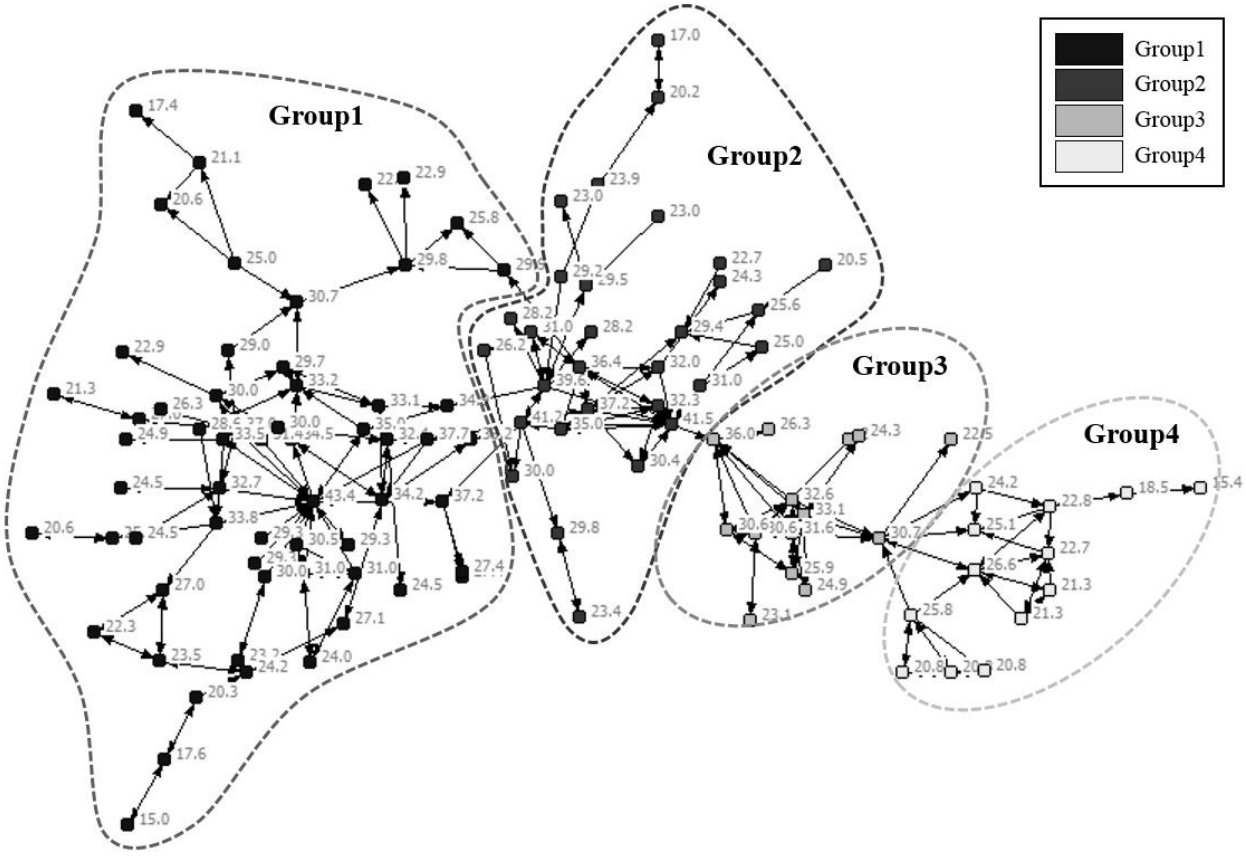

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Fig. 6 Closeness Centrality Index (Assumption)